

ENVIRONMENT, HEALTH, & PEOPLE

An Update from USAID's Environmental Health Project

Spring 1998

GIS in Malaria Surveillance: Great Expectations

USAID's Infectious Diseases Strategy recognizes the utility of GIS as a surveillance tool.

Malaria is the number one vector-borne disease in terms of mortality and morbidity, causing over two million deaths yearly and human suffering on a large scale. USAID is renewing its efforts in malaria control and prevention as part of its new Infectious Diseases Strategy.

The first step in any control strategy is to reach an understanding of the parameters of transmission in the target area. Malaria is not the same everywhere; numerous vectors with different breeding and biting patterns carry the disease, and there are several varieties of malaria. Information must be gathered on the vector, the parasite, people's behavior, and the environment. Thus, a malaria assessment is a meeting place for cartography, entomology, epidemiology, demography, sociology, anthro-

pology, climatology, environmental science, and other technical specialties.

Data from Multiple Sources

For those conducting an assessment or planning control/prevention strategies, the first challenge is to identify and collect accurate data. The second is to correlate the data so that inter-relationships among them come to light. In malaria programs supported by EHP, this challenge is being met through mapping.

Formerly, mapping was a laborious, manual process that produced a static picture of an area. Today, manual cartographic systems are being replaced by computer-adapted geographic information systems (GIS). Although GIS has been used extensively in other fields, putting it to practical use in the

health field is relatively new.

GIS offers the ability to process, display, monitor, and analyze data beyond the capacity of any manual system. Bringing data together leads to new insights for control strategies, new possibilities for monitoring, and a basis for allocating resources.

If no electronic map is

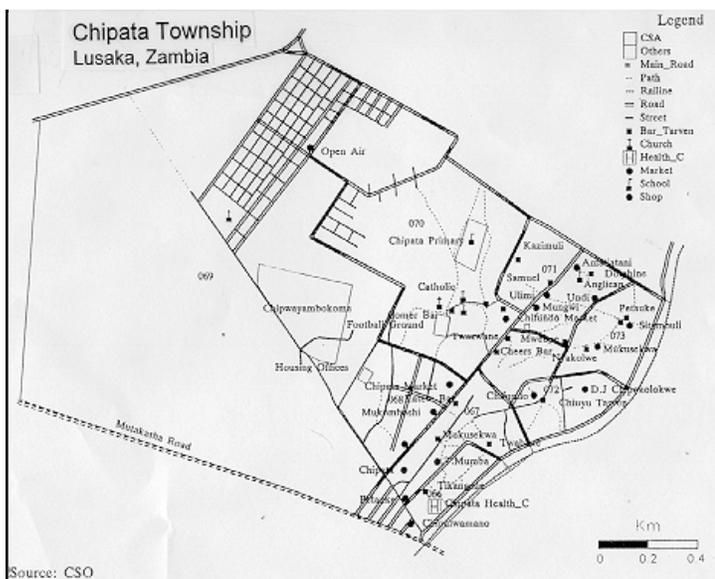
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available, GIS mapping for environmental health applications can begin with an accurate hard copy map or aerial photo which is digitized and converted to an electronic format. Health facility location, ecological/environmental features, mortality and morbidity figures, population dynamics, and other data are "layered" onto the basic map.

Local counterparts are trained in the operation of the technology, including identifying and collecting accurate data, developing databases, and converting data to a format which can be plotted on the electronic map. To supply the quality data needed, many ministries and agencies may be involved in addition to the health sector. Also, it may be necessary to go out into the community to survey conditions firsthand.

Existing GIS products require modest investments in hardware and software (\$5,000 - \$10,000). Three widely used software systems are ArcInfo, Atlas GIS, and MapInfo. To facilitate the sharing of map data and to enhance the sustainability of GIS activities, hardware and software components should be ones commonly



Maps of smaller areas, such as townships or neighborhoods, can be remarkably detailed, showing streets, paths, bars and restaurants, shops, and so on. GIS allows planners to hone in on areas of concern.

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UPDATE: Current Activities of Note

EHP Boosts Water Sector Decentralization Initiatives

USAID/Dominican Republic and its NGO partners have financed a number of water and sanitation activities in the past six years. The activities promoted the "total community participation model" in which communities construct and manage the systems.

This model will be used by the National Institute of Potable Water and Aqueducts (INAPA), the rural water authority, in a program to transfer the O&M of 252 rural water systems to local management. EHP is providing technical assistance to INAPA in creating a Decentralization Unit and developing a strategy for communicating with community members about their new roles as managers. The communications strategy includes a behavior change component dealing with personal hygiene, proper water storage, and the conservation and responsible use of water.

Water sectors in many developing countries are being decentralized to improve service. In Slovakia, EHP is engaged in a large-scale decentralization effort, and, in South Africa, EHP is advising Transition Local Government

Units in the Greater Bushbuckridge and Nsikazi North Areas, both of which were part of the former homelands under apartheid, on establishing a delivery structure for community-based water management. (See page 8 for a new report on this activity.)

Wells and Springs Slated for Fast-Track Rehabilitation

The Water Authority of Jordan has requested USAID fast-track assistance in returning bacteriologically and chemically contaminated wells and springs to service at approximately 10 sites. Several of the sources are shut down intermittently by the Ministry of Health.

Currently, water is being diverted from other sources to the 125,000 residents who rely on the contaminated wells and springs. But these diversions take place only about once every two weeks. Residents make up the shortfall by buying water from vendors, some of whom are filling their trucks with water from the contaminated sources.

If these water sources can be rehabilitated before the next dry season, residents will be saved from greater hardships and health risks.

EHP is providing technical assistance, which includes assessment of the problem at each site and design of a solution.

KAP Study Guides Community Dengue Control in Guatemala

In late 1996, USAID made funds available to the Ministry of Health in Guatemala to develop and implement an IEC program (information, education, communication) for the prevention of dengue and dengue hemorrhagic fever (DHF) in the Department of Escuintla, where an increase in DHF had raised the fear of an epidemic. While dengue fever is a temporarily debilitating disease, DHF is often fatal.

The program was to focus on elimination of *Aedes aegypti* breeding sites through community action; other control methods—application of insecticides against adult or larval vectors—were too expensive and infeasible programmatically. The vector favors breeding in places where domestic water collects: storage tanks, flower pots, discarded tires, wash basins, etc.

Before the program was designed, EHP, in collaboration with INCAP (Nutrition Institute for Central America and Panama), assisted the Guatemalan Ministry of Health to conduct a KAP (knowledge, attitudes, and practices) study, collect baseline data, and analyze the findings. The survey established the level of larval infestation, assessed community awareness of the problem, and identified behaviors to be modified.

Based on the results of the KAP study, a full set of education materials on dengue control was produced for the Ministry of Health in Guatemala and other Latin America countries.

Although there was some initial resistance to the need for the KAP study, the follow-up evaluation determined that it was the key unifying factor in keeping all actors focused on the same goal.



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Youthful water-users pose at a spring in Jordan recently assessed by EHP and slated for rehabilitation (see story on opposite page). Photo: Janelle Daane

Update (from page 2)

As a result of the nine-month program, larval infestations have decreased and the number of reported cases of dengue in Escuintla have gone down, in contrast to the rest of Guatemala, where cases have gone up over the same period. The Ministry of Health

plans to apply the methodology of this program to other areas in Guatemala.

CIMEP/Benin Lays Groundwork for Regional Scale-Up

Community groups in nine pilot neighborhoods in three Beninese towns are fully engaged in an effort to identify

and lower environmental health risk factors. Their work is being carried out using the CIMEP approach: Community Involvement in the Management of Environmental Pollution. The CIMEP/Benin project was described in the Fall 1997 issue of *EH&P*.

Using the information from community maps and baseline epidemiological and behavioral data, the communities will design low-cost projects to change high-risk environmental conditions and behaviors.

Scale-up to other locations in Benin and throughout the region has been a part of CIMEP/Benin's strategy from the outset. In May, a regional workshop brings together mayors, parliamentarians, NGO representatives, community leaders, private sector representatives, environmental health specialists, and donor representatives from countries in the region. The goal of the workshop is to expand the understanding of community-based approaches for environmental health and promote regional scale-up.

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EHP Global Network on the Health Effects of Indoor Air Pollution in Developing Countries

EHP has established an ARI (acute respiratory infection) network on the Internet. "EHPARI" is an interactive forum for dialogue and information exchange among individuals and organizations interested in indoor air pollution and its effect on health.

ARI is the leading cause of illness and death in children under five in developing countries. Worldwide, each year just under four million children die of ARI, primarily pneumonia. Evidence is growing that indoor air pollution is an important risk factor for ARI. Indoor air pollution is also linked to chronic obstructive lung disease in adults and low birth weight in newborns.

Smoke from heating and cooking fires, especially those that use biomass fuel or coal, is the primary cause of indoor air pollution. An estimated one billion people, mostly women and children, are regularly exposed to unhealthy levels of domestic smoke. Public awareness of the dangers of indoor air pollution in developing countries is seriously lacking.

EHPARI's goals are to link the health and energy sector experts involved in addressing indoor air pollution problems, to create awareness of the effects of indoor

smoke on the health of women and children, and to stimulate interest in interventions to reduce exposure to indoor air pollution. These include improved stove programs, improved housing, behavioral change, health education activities, research, and policy initiatives.

Since its inception in September 1997, EHPARI has generated considerable interest. By March 1998, 144 members from 30 countries had joined. A recent survey of network members revealed that 90% of respondents had worked in countries where indoor air pollution was a problem. Respondents' major interests centered on health, energy, research, and policy issues.

An annotated bibliography, network newsletters, contacts, and other ARI information are also currently available via the EHP website at:

<http://www.access.digex.net/~ehp>.

To join the EHPARI network, obtain a printed copy of the bibliography, or request additional information, contact EHP.

— Dan Campbell (Email: campbelldb@cdm.com)

Update (from page 3)

Seeds for scaling up nationally in Benin have been planted through training public sector staff, organizing periodic round tables to keep policymakers apprised of CIMEP activities, and supporting the creation of a national-level cross-sectoral environmental health committee with representatives from the ministries of health, environment, interior, and planning.

EHP has applied CIMEP in several locations and has produced a 30-page booklet laying out the steps for implementation (available in English, French, and Spanish).

Egyptian Environmental Affairs Minister Endorses EHP Lead Abatement Action Plan

In 1994, a USAID-supported study of environmental health risks in Cairo, Egypt, concluded that lead exposure was one of the city's three most important environmental health problems. Children are at higher risk than adults from environmental lead. Child blood lead levels as low as 10 $\mu\text{g}/\text{dL}$ (micrograms per deciliter) have been associated with learning disabilities and the loss of IQ points.

Prompted by these findings, the government of Egypt and USAID agreed to collaborate on a lead exposure abatement plan for Cairo and the entire country.

The plan was based on EHP's environmental sampling survey to estimate the magnitude and extent of children's exposure to lead. Investigators collected over 1,000 samples of soil, dust, drinking water, paint, foods, cosmetics, traditional medicines, newspapers, and ceramics and analyzed them for their lead content. Based on that data, it was estimated that 64% of children six and under had blood lead levels higher than 10 $\mu\text{g}/\text{dL}$ and 14% had levels higher than 20 $\mu\text{g}/\text{dL}$. Levels could be even higher than these estimates, because not all possible sources of lead exposure were covered in the

assessment. (The U.S. Centers for Disease Control and Prevention is supporting testing of blood lead levels in children from the Greater Cairo area to compare with the estimated levels.)

The Lead Exposure Abatement Plan (LEAP) includes five initiatives:

- Reduce the amount of lead ingested through food
- Reduce the use of certain types of eye makeup (*kohl*) that contain lead
- Reduce the production and use of low-fired lead-glazed ceramics
- Ensure that manufacturers do not increase lead additives in paint
- Conduct a public awareness campaign of the health hazards of lead exposure and ways to reduce it.

The plan was prepared in coordination with the Egyptian Ministry of State for Environmental Affairs (MOSEA) and the Ministry of Health and Population. Key Egyptian officials presented the plan at a September 30, 1997, workshop in Cairo. The newly appointed Minister of State for Environmental Affairs expressed her strong endorsement of the plan, and all three directors within the Egyptian Environmental Affairs Agency (EEAA) participated in presenting details of the plan. MOSEA/EEAA will convene an interministerial steering committee to review and adopt the plan and prepare for implementation. (See page 8 for a listing of reports on LEAP.)

Changed Behaviors Net Reduction in Child Blood Lead Levels

In Zlatna, Romania, emissions from an antiquated copper smelter subject residents to an elevated level of environmental lead, putting them at risk of physical and neurological damage. EHP has been involved in a three-year-long program of technical assistance to reduce the exposure of young children to lead and to increase the local environmental protection agency's capacity to

monitor air quality and to improve occupational health and safety in the plant, which employs 2,500 workers. A parallel effort to reduce emissions is being carried out by the USAID-sponsored Environmental Action Plan Support (EAPS) project.

Results of the program were documented at the end of 1997, as the project entered a new scale-up phase. The major health result was a 30% reduction in average blood lead levels of children under six, from 40 to 28 $\mu\text{g}/\text{dL}$ (micrograms per deciliter). This dramatic reduction was achieved largely through behavior changes, since the emission reduction program was delayed.

Blood lead levels of workers also improved. Early in the program, tests showed that 31% of workers in hazardous areas had blood lead levels well above the standard of 40 $\mu\text{g}/\text{dL}$ for U.S. workers. According to follow-up testing at the end of the program only 8% exceeded the U.S. standard.

Changes in knowledge, attitudes, and practices undergird the health results. In 1995, close to 83% had no awareness about lead poisoning and how to avoid exposure. In 1997, that percentage dropped to 22. Improved hygiene behaviors, such as washing

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Contact EHP to receive a step-by-step guide to applying an innovative community participation approach. Specify English, French, or Spanish.

Community Management of Water Supply in Cité Soleil, Haiti, Meets Cost-Recovery Goals

EHP has been working in partnership with the Haitian NGO Centres pour le Développement et la Santé (CDS) to establish an autonomous district to manage a \$2.5 million water supply system for Cité Soleil constructed with UNDP funds. CDS created a separate institution, CADEPA, to manage the water system, which consists of a water tower and community-managed public fountains selling water by the bucket. CADEPA also provides environmental sanitation services and runs demonstration latrine projects.

The water fees were structured so that all O&M costs for the water system, as well as additional environmental sanitation services, would be covered.

A final monitoring visit in September 1997 documented the following results.

Institution-Building. A fully functioning water supply and sanitation utility has been created, including the development of appropriate financial and O&M systems. CADEPA has created 124 jobs to date.

Financial Analysis. In July and August 1997, its fifth month of operation, CADEPA sold enough water to pay for its core administrative and water supply O&M costs. Careful management of expenses has resulted in a net balance of \$16,250, which will be used for solid waste activities.

Community Participation. CADEPA has established a community-based institution: 41 fountain committees have been formed and are operating 62 of the 76 fountains; 65 fountain keepers have been trained; 7 zonal committees have been formed with responsibility for collecting receipts and implementing zonal sanitation activities.

Water Supply and Sanitation. In August 1997, CADEPA met or exceeded all monthly water supply targets, such as sales of water, percentage of unaccounted-for water, water meters, etc.

Next steps are to improve and expand the solid waste collection system and increase water sales. The two are linked because a portion of the fees collected for water is to be used for environmental health services.

Improving solid waste is key to improving health in the area. Because of the lack of solid waste collection, residents throw their garbage into drainage canals and thus block the flow of household and industrial liquid waste, including fecal matter. The drainage canals overflow regularly into streets and people's homes, creating a health risk.

— Fred Rosensweig

Update (from page 4)

children's hands before they eat or enter the house, were also recorded.

The centerpiece of the assistance was collaboration among local governments, teachers, doctors, plant workers and managers, and NGOs to create lead-free play areas, upgrade bathrooms, plan and carry out health education programs, counsel families in reducing children's exposure, and improve worker practices to reduce their exposure and to prevent lead-contaminated dust from being carried home.

Other aspects of technical assistance included procurement of equipment for monitoring environmental lead and testing blood lead levels and training in problem solving, goal setting, the design of environmental sampling programs, data analysis, and leadership skills. (See page 8 for a new report on this effort.)

Peruvian Firms Seek ISO 14000 Compliance

To increase their efficiency and trade competitiveness, many industries in Latin American countries are seeking compliance with ISO 14000 standards for environmental management systems (EMS) as set by the International Standards Organization (ISO).

ISO 14000 documents provide guidance and specifications for the development of a company's EMS, which includes allocation of resources, assignment of responsibilities, and ongoing evaluation of practices, procedures, and processes. Assessing inputs and outputs (including waste) at each phase of the production process reduces costly end-of-pipe treatment and containment and lessens the environmental impact of a company's waste stream.

EHP has been providing assistance in meeting ISO 14001 requirements (a document in the ISO 14000 series) to Latin American industries. In December 1997, EHP planned and delivered a workshop in Peru entitled "ISO 14001 EMS: Planning and Implementation." Eleven firms participated in the workshop, including breweries, fish meal producers, textile firms, and others. The firms brought along environmental consulting counterparts to assist them in developing their EMS.

As a follow-up to the workshop, EHP set up a mechanism for the firms participating in the workshop to tap into additional support and guidance from the ISO trainers in the preliminary stages of the development of their EMS plans. □

GIS in Malaria (from page 1)

used in the target country. Data acquisition, quality analysis, and conversion are significant components of GIS programs.

EHP Experience

USAID missions in three countries are providing funds for technical assistance through EHP in programs to increase health officials' capabilities in GIS.

Zambia: Understanding and Tracking Urban Malaria. Outbreaks of malaria and periodic epidemics of cholera have become a serious concern in Lusaka, the capital of Zambia. Until the introduction of GIS, the Lusaka District Public Health Office and the Lusaka City Council have had no systematic approach to tracking the geographic spread of cholera and malaria, nor have they had any accurate environmental health maps of a scale that can be used for planning of prevention and control.

To fill these gaps, Lusaka's District Health Management Team and City Council are learning to use GIS mapping as an epidemiological tool for planning and monitoring disease control programs.

The GIS maps being developed for Lusaka can display the following variables as overlays: district and township boundaries, health facilities, schools and churches, market places, population density, industrial, commercial, and residential areas, roads and railroads, boreholes (water), sewage distribution and treatment facilities, solid waste dump sites, malaria vector breeding sites, and malaria and cholera cases reported by region or clinic. Communities assist in gathering and verifying local information.

Mapping has enabled the District Health Management Team to identify malaria- and cholera-prone areas where preventive activities will be accelerated. Gradually other sectors are being drawn in to address issues such as water and sewage, which impact on community health. Key political leaders are being

educated on the factors that contribute to increased health risks in certain areas.

Eritrea: Stratification for Effective Malaria Control. After 30 years of civil strife, the government of Eritrea is eager to build local capacity to address the country's heavy disease burden, particularly from malaria, which is the most important endemic disease affecting health and productivity in much of the country.

The government's new approach to malaria prevention is based on the notion of selective vector control and targeted, site-specific preventive measures. Regions with high rates of malaria will be carefully delineated or stratified, and risk factors will be identified so that appropriate prevention activities will be aimed at the populations at risk.

A GIS-based mapping system plays a leading role in carrying out this new approach. Not only can GIS integrate diverse data, but it can also capture spatial and temporal events to determine when, where, and how to intervene and to evaluate the results of such interventions. For example, GIS can indicate when and where to apply larval control measures or what swampy areas are priority for draining.

Nigeria: GIS As a Key Tool for a Rapid Malaria Assessment. USAID's Urban Private Health Sector Project in Nigeria, which is being implemented by BASICS, has established Community Partnerships for Health (CPHs) to mobilize businesses, NGOs, and communities in Lagos to improve the health status of children. Malaria is perceived to be a serious problem in Lagos, but until a systematic effort has been instituted to define the problem, effective control strategies cannot be adopted.

Is the disease identified as a problem truly malaria? If it is malaria, is it contracted locally (indigenous) or is it imported from visits to rural areas? What vectors are involved? Where do they breed? When and where do they

bite? Answers to these and many other epidemiologically relevant questions will be sought through a rapid assessment of the overall prevalence and distribution of malaria and related factors. Detailed mapping and GIS are tools to be used in the assessment.

The GIS mapping component of the assessment is developed in three steps:

1. Conduct a rapid assessment of the malaria situation, with these elements:
 - Human: demographic profile, socioeconomic status, population movements
 - Vector: entomological assessment, localization of breeding sites, biting patterns
 - Parasite: species of parasite, prevalence of parasitemia, verification of clinical diagnosis, identification of suspected places of infection
 - Health facilities: location of health services for diagnosis and treatment
 - Infrastructure: roads, railroads, public markets, water sources, etc.
 - Environment: swamps, rivers, lakes, dumps, etc.
2. Display the information on the pre-existing digitized base maps using GIS
3. Define and delineate risk areas for local transmission.

EHP is conducting the assessment in collaboration with the CPHs, which will use the information to develop an appropriate malaria prevention and control strategy.

Possible interventions include increased use of insecticide-impregnated bednets and mosquito screens in high mosquito areas, environmental clearing targeting anopheline mosquito areas, programs to enhance community awareness of malaria transmission risk factors and how to reduce them, and enhanced use of laboratories for monitoring trends and drug resistance.

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Alarming Facts about Sanitation in Developing Countries

A million tons of feces. Each day, the inhabitants of the world generate a million tons of excrement. What happens to it? In developed countries, excrement is normally collected, carried away, and treated in water-borne sewage systems. But in developing countries, access to sewerage or some type of on-site sanitation is not the norm. Most excrement is disposed of at random where it pollutes the environment and presents a severe health hazard—not to mention erosion of the quality of life.

Two-thirds lack sanitation. In developing countries only about 10% of the population—mostly city-dwellers in the better-off parts of town—have access to sewerage; about 20% have access to some type of on-site sanitation. In round figures, two-thirds of people in developing countries lack sanitation.

Existing systems often fail to protect public health.

From a public health perspective, it is difficult to take any comfort from access figures: as low as they are, they misrepresent reality. Most sewage systems in developing countries (and some in the developed world as well) merely carry the sewage away from one location and discharge it untreated in another—usually a river or an ocean. Likewise, on-site facilities, because they are not properly designed or located, often release pathogens into local water bodies or groundwater. Such inadequate

systems may protect their users, but they present a hazard to neighboring or downstream communities.

The situation is worsening. Sanitation coverage has fallen proportionally over the 1990s: the percentage of persons with access to hygienic sanitation has declined from 36 to 34%. At the same time, crowded conditions in fast-growing peri-urban areas, totally unserved by urban infrastructure, are accentuating the health hazards posed by lack of sanitation, which already causes 3.3 million deaths per year from diarrheal diseases.

The number one environmental health problem.

Lack of sanitary excreta disposal is by far the most severe environmental health problem in developing countries today.

UNICEF's *Progress of Nations* (1997) makes the case for action on sanitation in the following terms: "*On the brink of the 21st century, half the world's people are enduring a medieval level of sanitation . . . This unconscionable degradation continues despite a fundamental truth: Access to safe water and adequate sanitation is the foundation of development. For when you have a medieval level of sanitation, you have a medieval level of disease, and no country can advance without a healthy population.*"

— Thanks to WHO's "Environmental Health Newsletter," October 1997, for facts and figures.



Access to adequate sanitation (like these community latrines in Kampala, Uganda) is the exception, not the rule, in developing countries.

Photo: Liba Taylor, Panos Pictures

GIS in Malaria (from page 6)

Benefits and Side Benefits

EHP experience with GIS mapping is that the process of producing the maps is often just as valuable as the final product. Key to the mapping exercise is training in accurate and representative data collection, standardization, and analysis. The inter-sectoral collaboration involved in gathering all the data needed for a map and the sharing and coordination of data can become useful habits that lead to effective cross-sector programs.

In addition, there is considerable spillover benefit in the creation of base maps, as they can be used to display demographics, health facility use patterns, rainfall, crop production, ecological changes, and so on. Such information can be vital to planning in other sectors, which may

lead to significant health benefits to the population.

Importance of Surveillance

Local surveillance and assessment of site-specific malaria problems are prerequisites for embarking on any control activity. Identifying early warning signs of epidemics and resurgence of endemic problems and determining regional and inter-country/cross-border approaches are particularly important for environmentally linked diseases.

USAID's Infectious Diseases Strategy recognizes the importance of surveillance and the utility of GIS as a surveillance tool. As stated in the Strategy, USAID will "explore opportunities to promote GIS and disease mapping in a practical and sustainable manner in focus countries, building on existing databases."

— Panduka Wijeyaratne

Recent EHP Publications

For a list of all EHP publications, contact EHP or visit our website—<http://www.access.digex.net/~ehp>.

Issues & Options for Transfer of Water Distribution Responsibility...in South Africa (Activity Report 30, 140 pages). Discusses the transition from a national to a decentralized water management system in a rural area of South Africa.

Lead Exposure Abatement Plan for Egypt. Summarizes in three reports a multi-year effort to address lead pollution: an assessment of institutions involved in lead reduction efforts in Egypt (#31, 47 pages); the findings of an extensive environmental sampling program and data analysis (#32, 100 pages); and an action plan to reduce children's exposure to lead (#37, 78 pages).

Designing a Sanitation Program for the Urban Poor: Case Study from Jamaica. (Activity Report 34, 52 pages). Describes the elements of planning a successful sanitation program.

Evaluation of the Urban Environmental Sanitation Project in Jamaica (Activity Report 35, 124 pages). Provides a detailed

picture of program implementation and results in a low-income area near Montego Bay, including health outcomes, financial mechanisms, and the outlook for replication elsewhere in Jamaica.

Summary of EHP Activities in Slovakia, Poland, and Romania (Activity Report 36, 136 pages). Surveys EHP-assisted efforts from 1995 to 1997 to incorporate environmental health in the curricula of medical and occupational health programs for medical students and continuing education programs.

Summary of Activities in Zlatna, Romania, 1994-1997 (Activity Report 45, 86 pages). Describes the successful cross-sector activities of citizens and local organizations to reduce exposure of children and workers to lead from a copper smelter in a small Transylvanian town.

Indicators for Programs to Prevent Diarrheal Disease, Malaria, and Acute Respiratory Infections: Report of a Technical Advisory Group Meeting, July 1997 (Activity Report 46, 60 pages). Lists and explains environmental health indicators for diseases causing high child mortality.

— Betsy Reddaway



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